State Water Resources Control Board

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MAR 13 2003

Water Docket Staff
Water Docket Mail Code 4101T
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue NW
Washington, DC 20460

MAR 14 2003

Attn: Docket ID No. OW-2002-0050

Dear Staff:

COMMENT ON ADVANCED NOTICE OF PROPOSED RULEMAKING ON DEFINITION OF "WATERS OF THE UNITED STATES"

Thank you for the opportunity to comment on the January 10, 2003 "Advance Notice of Proposed Rulemaking On Definition Of 'Waters Of The United States'" (ANPRM). The ANPRM responds to the 2001 U.S. Supreme Court decision in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers (SWANCC)* and requests comment on (1) whether commerce clause factors currently listed in federal regulation should continue as a basis for Clean Water Act (CWA) jurisdiction and (2) whether federal regulations should define "isolated waters," and if so how. In answering these questions the ANPRM suggests that the public provide information on projected environmental impacts, functions and values of waters that may be affected, projected impacts on commerce, other regulatory changes which should be made, the availability of state programs to protect affected waters, and the effect on TMDLs. As noted in our February 10, 2003 request for an extension of the comment period for the ANPRM, the inter-related nature of the above questions precludes a comprehensive response within the time available.

The *SWANCC* decision threw uncertainty over the use of the commerce clause to determine CWA jurisdiction over a poorly defined set of "isolated" waters. In clarifying this issue we believe it is legally and scientifically essential to refer to the overarching Objective of the CWA: " . . . to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." We respond to the two specific questions posed in the ANPRM from this perspective and broadly indicate how the proposed redefinition of "waters of the United States" could affect California's waters, economy, and water quality programs.

Our comments are enclosed. In summary, we recommend for legal, technical, economic, and programmatic reasons that the federal agencies maintain jurisdiction over the broadest scope of waters consistent with the *SWANCC* decision. We further recommend that any reduction in

federal authorities be phased in over a number of years and that the federal government provide substantial funding and technical assistance to the states to assist in the transition. We believe that failure to do so will result in significant losses to the quantity and quality of waters of the State and waters of the United States, with significant attendant ecologic and economic intra- and interstate repercussions.

Secretary Hickox of the California Environmental Protection Agency and Secretary Nichols of the Resources Agency have asked us to convey that they concur in the substance of our comments. It is also my understanding that you will be receiving a separate letter from Secretary Hickox and Secretary Nichols.

Should you have any questions, this issue is under the direction of Stan Martinson, Chief of the Division of Water Quality, who can be reached at (916) 341-5458 or marts@swrcb.ca.gov. You may also contact Oscar Balaguer, Chief of the Water Quality Certification Unit, who can be reached at 916-341-5485 or balao@swrcb.ca.gov.

Sincerely,

Arthur G. Baggett, Jr.
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STATE OF CALIFORNIA

State Water Resources Control Board

COMMENT ON ADVANCED NOTICE OF PROPOSED RULEMAKING ON DEFINITION OF "WATERS OF THE UNITED STATES"

March 12, 2003

The U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) have promulgated a January 10, 2003 "Advance Notice of Proposed Rulemaking On Definition Of 'Waters Of The United States'" (ANPRM). The ANPRM responds to the 2001 U.S. Supreme Court decision in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers (SWANCC)* and requests comment on (1) whether commerce clause factors currently listed in federal regulation should continue as a basis for Clean Water Act (CWA) jurisdiction and (2) whether federal regulations should define "isolated waters," and if so how. In answering these questions the ANPR suggests that the public provide information on projected environmental impacts, functions, and values of waters that may be affected, projected impacts on commerce, other regulatory changes which should be made, the availability of state programs to protect affected waters, and the effect on TMDLs.

The *SWANCC* decision threw uncertainty over the use of the commerce clause to determine CWA jurisdiction over a poorly defined set of "isolated" waters. In clarifying this issue we believe it is legally and scientifically essential to refer to the overarching Objective of the CWA: ". . ." to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[i] We respond to the two specific questions posed in the ANPRM from this perspective and broadly indicate how the proposed redefinition of "waters of the United States" could affect California's waters, economy, and water quality programs.

POTENTIALLY AFFECTED CALIFORNIA WATERS

We expect that California's waters could be heavily affected by the proposed redefinition of jurisdictional waters. California's climate and hydrologic regimes range from coastal rain forest to inland desert. Many parts of the State are arid or semi-arid, and mountain ranges cover much

of the State. In most places precipitation is highly seasonal, and varies greatly from year to year; and many basins receive little or no snowmelt. These environmental conditions result in a large inventory of swales, vernal lakes, vernal pools, desert seeps and springs, dry lake beds, ephemeral and intermittent headwater streams, and enclosed basins not draining to navigable waters. In this response we refer collectively to non-adjacent wetlands, enclosed basins and their tributaries, and headwater streams with the term "potentially affected waters."

1. California Waters.

California waters which seem to have the most risk of removal from CWA jurisdiction are:

i. Non-adjacent wetlands, including vernal pools and other, mostly seasonal, wetlands.

ii. Waters draining to enclosed basins, including playas, desert seeps and springs, and a number streams draining to the east side of the State.

iii. Headwaters streams, including intermittent and ephemeral drainages (e.g., low-order foothill and valley tributaries, desert washes) which may have surface hydrologic connectivity to jurisdictional waters only seasonally or during heavy rainfall years. Much of California's stream system falls into this category, and these waters are often located in areas subject to intense development pressure.

2. Species and Biodiversity

Potentially affected waters are critical to maintaining California's biodiversity and providing habitat for numerous federally listed endangered species. For example, some ephemeral streams, such as those found in Coastal Southern California, are known for the endangered bells vireo and yellow-billed cuckoo. Mountain snow-melt ponds and vernal pools provide habitat for endangered species of toads, shrimp, and salamanders; e.g, vernal pool tadpole shrimp and California tiger salamander. Potentially affected waters are especially critical to our arid and semi-arid regions. For example, desert playas and springs support diverse populations of plants and animals (e.g., endangered big horn sheep) that cannot survive in the harsh desert environment without these waters.

PROPOSED DEFINITION OF "ISOLATED" WATERS" AND COMMERCE CLAUSE BASES FOR JURISDICTION UNDER THE CWA

1. Isolated Waters

In the *SWANCC* decision the Supreme Court noted that in *United States v. Riverside Bayview Homes, Inc.* (1985) 474 U.S. 121, 106 S.Ct. 455, it "recognized that Congress intended the phrase 'navigable waters' to include 'at least some waters that would not be deemed 'navigable' under the classical understanding of that term.'" (531 U.S. 159, 171.)

> "We found that Congress' concern for the protection of water quality and aquatic ecosystems indicated its intent to regulate wetlands inseparably bound up with the 'waters' of the United States. It was the significant nexus between the wetlands and 'navigable waters' that informed our reading of the CWA in *Riverside Bayview Homes.*" (*SWANCC,* 531 U.S. at 167 (internal quotes and citations omitted).)

According to the Supreme Court, the extent to which non-navigable waters are reached by the CWA act is largely "informed" by the "nexus between" the water at issue and the "navigable waters." Equally clear is statutory language dictating that the purpose of the statute is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." (33 U.S.C. § 1251(a). See 531 U.S. at 166.) Any definition of the term "isolated waters" must be viewed in this context. While the jurisdictional reach of the statute may be informed by whether the water to be protected is navigable, the purpose of the CWA is to ensure the tripartite integrity of those waters. California thus proposes that the Corps and EPA define the term "isolated waters" as follows:

"Isolated waters" are those waters which, individually or cumulatively, have no affect on the chemical, physical, or biological integrity of the navigable waters (including their tributaries and adjacent wetlands), and whose loss would not diminish the chemical, physical, or biological integrity of the navigable waters (including their adjacent wetlands or tributaries).

By defining jurisdictional waters in terms of their effect on navigable waters, the agencies give due respect to both the Supreme Court's pronouncement that the ultimate goal of the CWA was to protect the navigable waters and Congress' express intent to protect their "chemical, physical, and biological integrity." The effect of many potentially affected waters upon navigable waters is detailed below.

2. Commerce Clause Factors

The ANPRM queries whether the commerce clause factors identified in 33 C.F.R. section 328.3(a)(3) should continue to define federal jurisdiction under the CWA. The "Migratory Bird Rule" invalidated in *SWANCC* was not actually a regulation, but a clarification of the section 328.2(a)(3) factors. Conspicuously, the Supreme Court only struck the Migratory Bird Rule, but not the factors upon which it was based. Had the Court intended to invalidate all connections to commerce (other than navigation), it would have struck the regulation directly at issue (the 328.3(a)(3) factors), rather than merely the clarification.

The Supreme Court in recent years has examined Commerce Clause jurisprudence, and explained that "the grant of authority to Congress under the Commerce Clause, though broad, is not unlimited." (531 U.S. at 173.) It appears that the Court is reconsidering the attenuated analysis used since the New Deal to determine whether there are sufficient connections to commerce. Nonetheless, commerce is plainly a legitimate basis for federal authority, and Congress' intent to protect waters for their commercial impacts is well established. Congress declared in section 404(g) that the CWA indeed protects "other waters". (33 USC § 1344(g).) While the Supreme Court did not elucidate in *SWANCC*, Congress did indeed expand the CWA's reach beyond exclusively navigation when it broadened the definition of "navigable waters" to include all "waters of the United States." (33 U.S.C. § 1362(7).) The Corps and EPA are legally bound to give effect to all provisions of the CWA, and ignoring the language in sections 404(g) and 502(7) would not be appropriate. The question then becomes what "other waters" are there, and how are they defined? California posits that those waters must be identified in terms of lawful federal jurisdiction, such as under the Commerce Clause. In lieu of the attenuated commerce analysis used in the past, California recommends the following grounds be maintained as acceptable bases to enforce federal jurisdiction under the CWA:

The commerce clause factors currently listed in federal regulations should continue as a basis for Clean Water Act jurisdiction to protect isolated, intrastate, non-navigable waters if:

i. The water has been designated by the State or United States as an Outstanding Natural Resource Water;

ii. The water has been designated by the State or the United States as a water whose protection is important for the protection of regional, statewide, or national economic interests; or

iii. There is a significant nexus between the water and a significant and demonstrable commerce interest that would be impaired if the water was not protected (e.g., tourism, drinking water supply, etc.).

Outstanding Natural Resource Waters are national resources that engender intrastate, interstate, and foreign commerce. Where a state or the federal government has designated a water as important for the protection of broad economic interests, the commerce authority should be exercised. Finally, by limiting other commerce nexi to "significant and demonstrable" commercial interests, the federal agencies implement the Supreme Court's holding that commercial connections not be attenuated, but be clear.

3. Other Bases for CWA Jurisdiction

While Congress may have a particular jurisdictional ground in mind when it chooses to regulate, nowhere is Congress required to identify all Constitutional bases for an enactment before it promulgates legislation. The CWA's reach over "waters of the United States" beyond navigable waters is justified not only when there are significant effects on commercial interests, but when other national or federal interests are implicated. California thus recommends that the Corps and EPA exert federal jurisdiction under the CWA in the following additional circumstances:

Clean Water Act jurisdiction should extend to isolated, non-navigable, intrastate waters when there is a significant nexus between the water and a significant and demonstrable federal interest that would be impaired if the water was not protected (e.g., protection of federal lands, abiding by treaties to which the United States is a party, etc.).

HOW POTENTIALLY AFFECTED WATERS SUPPORT THE INTEGRITY OF WATERS OF THE UNITED STATES

Non-adjacent wetlands and other potentially affected waterbodies generally perform the same site-specific and landscape level functions as do other waters.[ii] It is clear that potentially affected waters can and often do play a key role in protecting and maintaining the chemical, physical, and biological integrity of waters that are indisputably "Waters of the United States" - i.e., interstate and navigable waters, their tributaries and adjacent wetlands, and the territorial seas. Whether a specific potentially affected waterbody performs this function is subject to case-specific determination. Such consideration should include a review of the following:

1. Chemical Integrity.

We interpret the term "chemical integrity" to mean that the chemical composition of a waterbody is maintained within the range that fully supports the beneficial uses historically provided by that water. Potentially affected wetlands and headwater streams can play an important role in maintaining the chemical integrity of waters of jurisdictional waters and their removal or degradation may result in an increased addition of pollutants to waters of the United States, compromising their chemical integrity and their ability to support beneficial uses. The role of wetlands in nutrient cycling is well known. Wetlands can be sources, sinks, and transformers of chemicals.[iii] Hydrologically isolated wetlands by their nature act as traps for sediment, nutrients, and other pollutants entering them. Headwater streams are also very effective at removing pollutants.[iv]

2. Physical Integrity.

We interpret the term "physical integrity" to mean that the temperature, hydrologic regime, geomorphology, and other physical characteristics of a waterbody are maintained within the ranges that fully supports the beneficial uses historically provided by that water. Isolated wetlands and headwater streams play an important role in maintaining the physical Integrity of waters of the United States. Hydrologically isolated wetlands by their nature retain all stormwater flows entering them and the storage capacity of isolated wetland complexes can be enormous. Headwater streams are also very effective at detaining and de-synchronizing flood flows. Functioning isolated wetlands and headwaters thus decrease the amplitude of downstream flood peaks, avoiding damage to property, abnormal channel instability, and

associated impairment of beneficial uses. Isolated wetlands are also often important aquifer recharge areas, whereas wetlands adjacent to waters of the U.S are typically groundwater discharge areas. Loss of the recharge function of isolated wetlands could dewater such adjacent wetlands and reduce baseflow in streams, changing their hydrologic regimes and temperatures.

3. **Biological Integrity.**

We interpret the term "biological integrity" to mean that that the biological processes and diversity and abundance of organisms associated with a waterbody are within the ranges historically supported by that water. Non-adjacent wetlands and headwater streams play several important roles in maintaining the biological integrity of waters of the United States. First, as noted above, potentially affected waters can play an important role in maintaining the chemical and physical integrity of jurisdictional waters. Impairment of chemical or physical integrity will almost inevitably reduce biological integrity. Second, potentially affected waters can support the survival of animals and plants, which also use and contribute to the biodiversity of navigable waters. (*SWANCC* found that presence of migratory birds is an insufficient nexus with navigable waters to establish that Congress intended federal jurisdiction to attach. The SWANCC decision, however, did not consider the role of the water in maintaining the biological integrity of navigable waters.) Third, potentially affected waters can provide habitat connectivity[v] necessary to the survival of biota which also use and add to the biodiversity of navigable waters.

Finally, aside from their role in supporting the biological integrity of waters of the U.S., potentially affected waters play make a very important contribution to California biodiversity in their own right, providing unique habitats for many species, of which a large number are endemic, and a significant proportion of which are on federal and/or State endangered species lists.

POTENTIAL NEGATIVE ECONOMIC EFFECTS

Loss of aquatic integrity often causes economic impairment. Foreseeable adverse economic consequences include:

1. Loss of pollutant removal would degrade downstream waters, increasing treatment costs, making waters unsuitable for some uses, and requiring additional TMDLs with associated public and private costs.[vi]
2. Loss of flood storage capacity would increase economic losses from flooding and channel instability, requiring expensive flood control projects.
3. Loss of aquifer recharge could affect industrial, agricultural, and municipal uses of groundwater, and reduced stream baseflow would affect a myriad of economic interests.
4. Loss of headwater streams would reduce spawning and refuge habitat for commercially important salmon populations.[vii]
5. Loss of seasonal wetlands and headwater habitat would result in additional state and federal endangered species listings, with associated constraints on economic activity.
6. Where species are already federally listed as endangered, loss of federal jurisdiction would foreclose federal Endangered Species Act section 7 consultation and make project proponents subject to the more onerous section 10 process.
7. Loss of revenue from public recreation (e.g., bird-watching, sight-seeing).
8. Loss of federal regulation would put environmentally protective states at an economic disadvantage relative to less protective neighbor states, removing the "level playing field" that now exists and creating pressure for reduced state protection. The legislative history of the CWA clearly indicates that a central purpose of the CWA was to prevent this problem from occurring.

POTENTIAL NEGATIVE PROGRAMMATIC EFFECTS

Future rulemaking could diminish the reach of federal jurisdictional waters, affecting programs operating under CWA sections 303 (water quality standards), 311 (oil and hazardous substance spills), 401 (water quality certification), 402 (national pollutant discharge elimination system), and 404 (dredge and fill discharges). These sections comprise the regulatory core of the CWA's protection of water quality. It would be up to the states to replicate the federal responsibilities that would be withdrawn as a result of redefining jurisdictional waters. The state/federal CWA regulatory partnership has developed over thirty years. We anticipate that reducing the scope of

this partnership would cause significant program disruption, additional state costs, potential lapses in regulation, and an eventual reduction of federal funding support.

1. **CWA Section 402 Programs.**

   Loss of federal jurisdiction over potentially affected waters would affect CWA section 402 NPDES regulation of municipal, industrial, stormwater, and confined animal discharges to those waters. In California, many such discharges are to ephemeral and intermittent ("effluent-dominated") streams. Most of the new urban growth projected for California is located in headwater areas. We have at least two concerns. First, states would no longer have the firm criteria set forth in 40 C.F.R. 131.10 to determine how beneficial uses are to be designated, applied, and modified. It would be difficult for California to protect beneficial uses for the potentially affected waters which would be exempt from these regulations. Second, any effluent discharged to an ephemeral or intermittent stream will eventually drain to navigable waters. Impeding the ability of states to protect water quality in ephemeral streams would jeopardize the chemical, physical, and biological integrity of downstream rivers, lakes, wetlands, estuaries, and coastal regions. This would exacerbate the difficulties of formulating TMDL plans in the downstream jurisdictional waters, and would likely lead to additional waterbodies being listed as "impaired" under CWA section 303(d).

2. **CWA Section 401 and 404 Programs.**

   California has no "wetland permitting program" as such. The State relies on CWA section 401 as its primary CWA tool to protect wetlands, supported by state fish and wildlife protection authorities. Under CWA section 401, we have historically relied on the U.S. Army Corps of Engineers' (Corps) CWA section 404 program, and have not established independent wetland regulation. The State has no statewide definition of "wetlands," no policy analog to the CWA section 404(b)(1) guidelines, no consultation process with federal agencies to assure protection of federally listed endangered or threatened species, and no statewide wetland beneficial use designations to protect wetland functions such as pollutant removal, floodwater storage, and habitat connectivity. The State's existing programs do not replicate the Corps' protection of the potentially affected waters, and expanding these programs in the foreseeable future is unlikely given the State's budget crises. If funding were made available, preparing environment documentation for and adopting regulations and

policy to establish a State wetland program would take several years because of the controversial nature of this issue. Training staffs and adopting field-level protocols and guidance would take additional time.

OTHER REGULATORY CHANGES THAT SHOULD BE MADE

The following two regulatory changes would support implementation of our proposed definition of "isolated" waters and would correct shortcomings in how current regulation address dry-land stream systems.

1. Provide science-based, regionally appropriate guidance for determining whether or not a given waterbody is "isolated" per the proposed definition, obtaining assistance as appropriate from the National Academy of Sciences/National Research Council.

2. Modify delineation protocols for riparian areas to recognize the dynamic nature of Western dryland hydrologic regimes, and the associated effects on riparian location and function.[viii]

For the above legal, technical, economic, and programmatic reasons we recommend that the federal agencies maintain jurisdiction over the broadest scope of waters consistent with the *SWANCC* decision. We further recommend that any reduction in federal authorities be phased in over a number of years and that the federal government provide substantial funding and technical assistance to assist in the transition. We believe that failure to do so will result in significant losses to the quantity and quality of waters of the State and waters of the United States, with significant attendant ecologic and economic intra- and interstate repercussions.

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[i] CWA § 101.

[ii] The functions and values of "isolated" wetlands have been well documented. See for example:

National Research Council, "Values of Riparian Areas," in *Compensating for Wetland Losses Under the Clean Water Act,* Committee on Mitigating Wetland Losses, National Academy Press, Washington, D.C., 2001, p. 43.

Jennifer Ruffolo, *The U.S. Supreme Court Limits Federal Regulation of Wetlands: Implications of the SWANCC Decision,* California Research Bureau, California State Library, February 2002, p. 14.

Ralph W. Tiner, Herbert.C. Bergquist, Gabreal B. DeAlessio, and Matthew J. Starr, *Geographically Isolated Wetlands: A Preliminary Assessment of their Characteristics and Status in Selected Areas of the United States*, U.S. Department of the Interior, Fish and Wildlife Service, Northeast Region, Hadley, MA, June 2002, pp. 2-6.

[iii] The transport and transformation of chemicals in ecosystems, known as biogeochemical cycling, involves a great number of interrelated physical, chemical, and biological processes. The unique and diverse hydrological conditions in wetlands markedly influence biogeochemical processes. The standing water or intermittent flooding of wetlands causes some processes to be more dominant in wetlands than in either upland or deep aquatic ecosystems. More nutrients in wetlands are tied up in organic deposits and are lost from ecosystem cycling as peat deposits and/or organic export. This process of "carbon sequestration" helps counteract global warming by moderating human-caused increases in atmospheric carbon dioxide. Wetlands are also very effective in removing excess nutrients and other pollutants from aquatic systems, through chemical transformation, plant uptake, deposition, and other mechanisms. See:

S. Mark Dennison and James F. Berry, *Wetlands: Guide to Science, Law and Technology*, Noyes Publications, Park Ridge, New Jersey, 1993.

J. William Mitsch and James G. Gosselink, *Wetlands* (2nd edition), Van Nostrand Reinhold, New York, 1993.

[iv] A recent nationwide study demonstrated the role of headwater streams in maintaining the chemical integrity of navigable waters. Most of California' s runoff is channeled through the ephemeral or intermittent headwater streams where these transformations occur. See J. P Peterson, W. M. Wollheim, P. J. Mulholland, J. R. Webster, J. L. Meyer, J. L. Tank, E. Marti, W. B. Bowdwn, H. M., Valett, A. E. Hershey, W. H. McDowell, W. K. Dodds, S. K. Hamilton, S. Gregory, D. D. Morrall, "Control of Nitrogen Export from Watersheds by Headwater Streams," *Science* 292:86-88, 2001, April: ". . . the most rapid uptake and transformation of inorganic nitrogen occurred in the smallest streams . . . headwater streams typically export downstream less than half of the input of dissolved inorganic nitrogen from their watersheds . . . . Small streams may be the most important in regulating water chemistry in large drainages because their large surface-to-volume ratios favor rapid N uptake and processing. Yet small streams are endangered because they are the most vulnerable to human disturbance such as diversion, channelization, and elimination in agricultural and urban environments. Restoration and preservation of small stream ecosystems should be a central focus of management strategies to ensure maximum N processing in watersheds, which in turn will improve the quality of water delivered to downstream lakes, estuaries, and oceans." (Peterson, 2001.)

[v] "Habitat connectivity" refers to the need for plant and animal populations to have some mobility over the landscape, i.e., to avoid becoming "isolated" or "disjunct." Such mobility may occur at the level of the individual organism (e.g., a bird or turtle traveling between separated wetlands) and/or of the population (e.g., a plant species colonizing a new wetland through seed dispersal); and over different time scales. In recent decades a large body of research has demonstrated that such "isolated" populations face a high probability of eventual extinction, even if their immediate habitats are spared. In general, the smaller such an isolated population, the more quickly it will die out. Urban development typically fragments habitat by creating artificial landscapes which are movement barriers for most species. Unless mitigation measures are taken, isolated, non-viable populations are created as buildings, roads, and landscaping cut off lines of movement.

In the context of wetlands, "habitat connectivity" refers to three related phenomena:

a. The need of some animals to have access to both wetland and upland habitats at different parts of their life cycle. Some wetland animals, e.g., some amphibians and turtles, require access at different seasons and/or at different life stages to both wetland and to nearby upland. Preserving the wetland but not access to upland habitat will locally exterminate such species.

b. The ecological relationship between separate wetlands. Some wetland communities and their associated species comprise networks of "patches" throughout a landscape. Wetland plants and animals are adapted to the presence of wetland complexes within a watershed and are dependent on moving among the wetlands within the complex, either regularly or in response to environmental stressors such as flood or drought, local food shortage, predator pressure, or influx of pollution. Removing one such water from the complex will reduce the biological quality of the rest, and at some point the simplified wetland complex will be incapable of supporting at least some of the species, even though some wetlands remain.

c. The role wetlands and riparian corridors play in allowing larger-scale movements. Some strategically located wetlands and especially continuous strips of riparian habitat along streams facilitate connectivity at watershed and regional scales for terrestrial as well as aquatic and amphibious species.

As noted above, habitat connectivity is critical to biodiversity maintenance, and will become more so because of global warming. Significant range shifts and other responses to global warming have already occurred. The ability of biotic populations to move across the landscape may be critical to their survival in coming decades.

For the effects of habitat fragmentation and population isolation on the survival of plants and animals, see for example:

K. L. Knutson and V.L. Naef, *Management Recommendations for Washington's Priority Habitats: Riparian*, Washington Dept. of Fish and Wildlife, Olympia, WA, December 1997, p. 71.

R.F Noss and A.Y Cooperrider, *Saving Nature's Legacy; Protecting and Restoring Biodiversity,* Washington, D.C., Island Press, 1994, pp. 33-34, 50-54, 59-62, 61-62.

D.E. Saunders, R.J. Hobbs, and C.R. Margules, "Biological Consequences of Ecosystem Fragmentation: A Review," *Conservation Biology* 5(1), March 1991, pp. 18-32.

Michael E. Soulé, "Land Use Planning and Wildlife Maintenance, Guidelines for Conserving Wildlife in an Urban Landscape," *Journal of the American Planning Association* 57(3), 1991, pp. 313-323.

Michael E. Soulé, "The Effects of Habitat Fragmentation on Chaparral Plants and Vertebrates," *Oikos* 63, 1992, pp. 39-47.

United States Federal Interagency Stream Restoration Working Group, *Stream Corridor Restoration: Principles, Practices, and Processes*, October 1998, [Online]. Available from: http://www.usda.gov/stream_restoration. Printed copy available from: National Technical Information Service (NTIS), Springfield, VA, pp. 2-80, 2-82.

Regarding the relationship between wetland and upland habitats, see for example:

Vincent J. Burke and J. Whitfield Gibbons, "Terrestrial Buffer Zones and Wetland Conservation: A Case Study of Freshwater Turtles in a Carolina Bay," *Conservation Biology* 9(6), 1995, pp. 1365-1369;

C. Kenneth Dodd , Jr. and Brian S. Cade, "Movement Patterns and the Conservation of Amphibians Breeding in Small Temporary Wetlands"" *Conservation Biology* 12(2), 1998, pp. 331-339;

Raymond D. Semlitsch, "Biological Delineation of Terrestrial Buffer Zones for Pond Breeding Salamanders," *Conservation Biology* 12(4), 1997, pp. 1113-1119.

Regarding the ecological relationship between separated wetlands, see for example:

C. Scott Findley and Jeff Houlahan, "Anthropogenic Correlates of Species Richness in Southeastern Ontario Wetlands," *Conservation Biology* 11(4), 1997, pp. 1000-1009;

Lisa A. Joyal, Mark McCollough, and Malcom L. Hunter, Jr., "Landscape Ecology Approaches to Wetland Species Conservation: A Case Study of Two Turtle Species in Southern Maine," *Conservation Biology* 15(6), 2001, pp. 1755-1762;

Raymond D. Semlitsch and J. Russell Bodie, "Are Small, Isolated Wetlands Expendable?" *Conservation Biology 12(5),* 1998, pp. 1129-1133;

National Research Council, *op. cit.,* 2001, p. 42;

Nature Conservancy, *op. cit.*, July 2000, p. 10.

Two recent reports comprehensively review observed effects of global change on plant and animal range shifts, advancement of spring events, and other responses. See:

Terry L. Root, Jeff T. Price, Kimberly R. Hall, Stephen H. Schnieder, Cynthia Rosenzweig, and Alan Pounds, "Fingerprints of Global Warming on Wild Animals and Plants," *Science* 421(2), January 2003, pp. 57-60.

Camille Parmesan and Gary Yohe, "A Globally Coherent Fingerprint of Climate Change Impacts Cross Natural Systems," *Science* 421:2, January 2003, pp. 37-42.

[vi] Replicating the pollutant removal functions of natural wetlands is expensive. On February 4, 2003, the California State Water Resources Control Board approved a grant of $1.2 million to enlarge a wetland area behind Prado Dam in Riverside County. The wetland was planted and is maintained to filter contaminants from the Santa Ana River. In recent years California has allocated large sums for wetland restoration under CWA section 319 and other grant programs.

[vii] For the value of headwater streams to salmon and trout, see:

Don C. Erman and Vernon M Hawthorne, "The quantitative importance of an intermittent stream in the spawning of rainbow trout," *Transactions of the American Fisheries Society* 105(6), 1976, pp. 675-681.

N.P Peterson and L.M.Reid, "Wall-base channels: their evolution, distribution, and use by juvenile coho salmon in the Clearwater River, Washington," in: J.M. Walton and D.B. Houston, eds: *Proceedings of the Olympic Wild Fish Conference. 23-25 March 1983,* Port Angeles, 1984.

[viii] Much of Californian riparian function is delineated out of federally jurisdictional waters in most years. In the East, the physical indicators demarcating "waters of the United States" correlate with the portion of the floodplain providing wetland and riparian functions; in more arid regions, they do not. Dynamic Western hydrologic regimes result in reduced CWA protection because the physical characteristics specified in 33 C.F.R. 328.3(e) - scour lines, flood debris, etc. - used to delimit "waters" are left by frequently recurring floods, whereas riparian functions can be supported by less frequent floods. In the East, this is unimportant because seasonal and annual flow variations are muted. For example, the increase in flow between the one-year and 50-year flood in a Pennsylvania watershed is 2.5 times (i.e., the 50-year flood carries 2.5 times as much water as the one-year flood). Western dryland systems, however, are much more variable. The same figure in a dryland stream is 280, and in small southern California dryland basins the 50-year flood may carry 400 times as much water as the one-year flood. Western riparian vegetation has adapted to establish and survive in portions of the floodplain inundated relatively infrequently, beyond the boundary of physical characteristics left by the frequent flood events and hence outside of federal CWA jurisdiction. See:

Aaron Allen and D. Malanchuk, *Guidelines for Jurisdictional Determinations for Waters of the United States in the Arid Southwest,* USACOE, South Pacific Division, June 2001.